



globally leveraged integrated data explorer for research

# GLIDER: Visualize, Analyze and Mine Satellite Imagery Using a Single Tool

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<http://miningsolutions.itsc.uah.edu/glider/>



**ESIP Viz Cluster**  
**May 9, 2011**



# GLIDER - motivation

- Software tools that allow users to visualize, analyze and mine satellite imagery are currently limited.
- Available commercial packages are expensive.
- None of these packages provide all the GLIDER features

# GLIDER Features

- *Visualize and analyze* satellite data in its native sensor view.
- Apply different *image processing algorithms* on the satellite data.
- Apply different *pattern recognition/data mining algorithms* on the satellite data.
- *Project* satellite data and analysis/mining results onto a globe and overlay additional layers.
- Provides *multiple views* to manage, visualize, and analyze satellite data.

# GLIDER is using:

- ADaM
  - ADaM (Algorithm Development and Mining) toolkit
  - Contains 140+ image processing, pattern recognition and machine learning algorithms
- IVICS
  - Interactive Visualizer and Image Classifier for Satellites (IVICS)
  - Provides capability to visualize satellite imagery and select samples for supervised classification
- World Wind
  - Project satellite data and analysis/mining results onto a globe and overlay additional layers

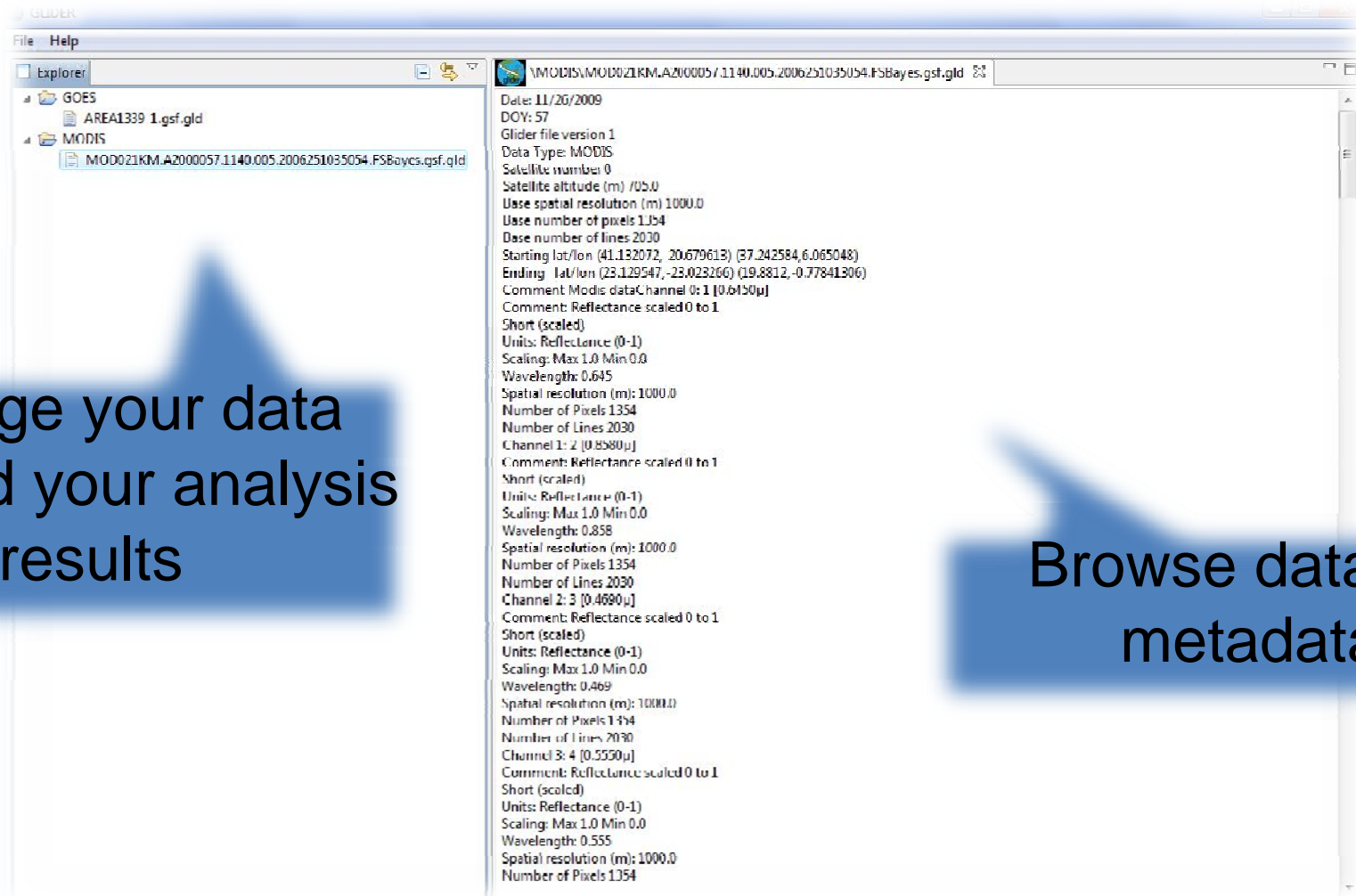
# GLIDER Architecture

- Integrates existing tools
  - ADaM: UAHuntsville's Algorithm Development and Mining Toolkit
  - IVICS: UAHuntsville's Interactive Visualizer and Image Classifier for Satellites
  - WorldWind: NASA's 3-D globe visualization system
- Eclipse Java RCP provides the framework
  - Plug-in based modular design
  - Code reuse
  - Cross-platform support (Windows, MacOSX, Linux, Solaris)
  - Manages GUI layout
  - Allows branding
  - Access to a large suite of existing plug-ins

# Data Currently Supported in GLIDER

- Direct support in GLIDER
  - MODIS Terra and Aqua
    - L1B Imager data 1km, 500m, 250m
    - L2 cloud mask, aerosols,
  - AMSU
  - SSMI
  - TMI
  - CALIPSO (partial)
- Import from IVICS/GSF
  - ASTER
  - GOES McIDAS
  - MSG
  - AVHRR LAC/GAC
  - VIRR
  - MAS
  - LANDSAT TM (NLAPS and GEOTIFF)

# GLIDER Views: Project Explorer



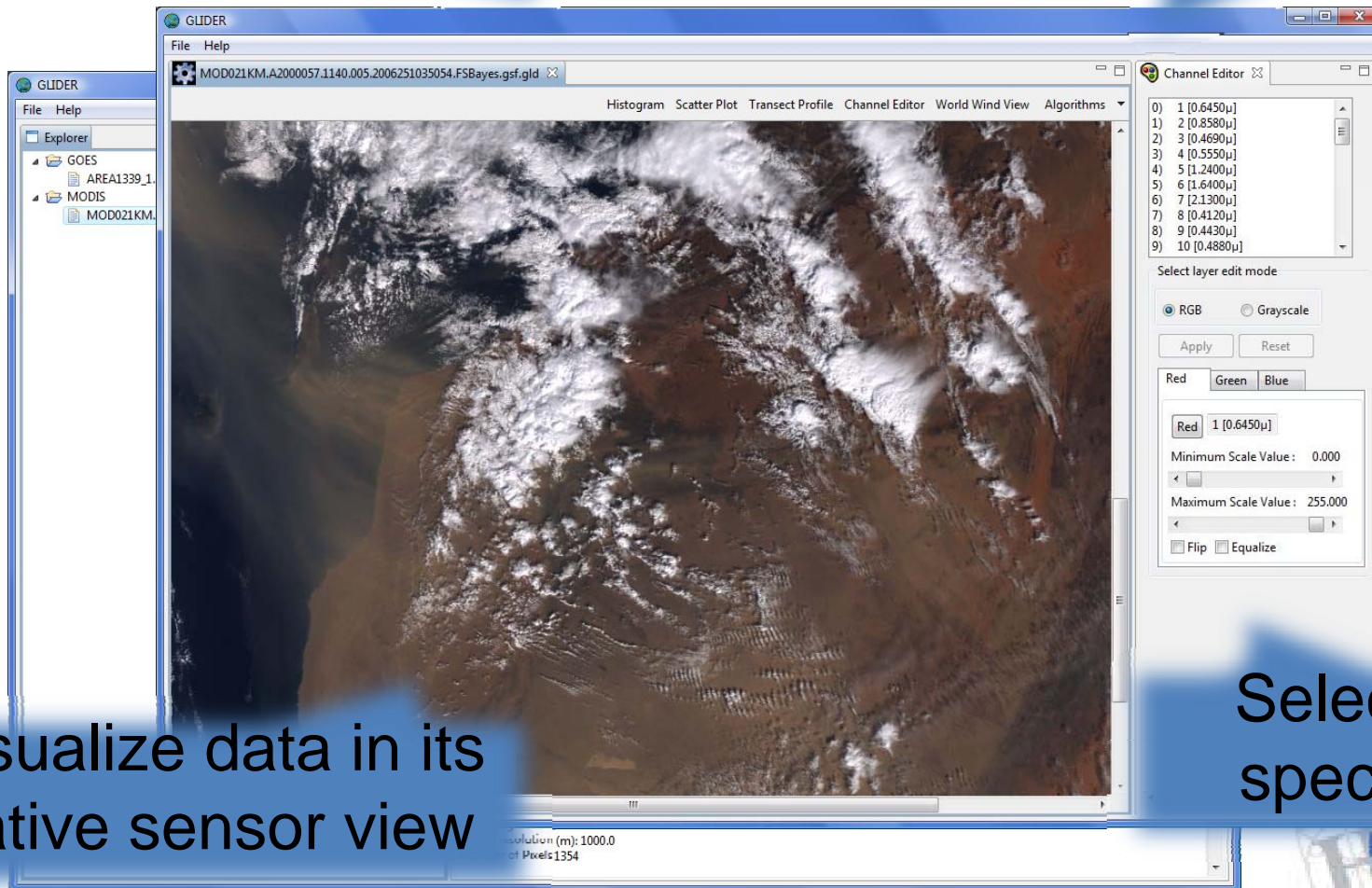
Manage your data  
files and your analysis  
results

Browse data file  
metadata

# GLIDER Views: Image Analysis View

Analyze image using  
different features

Apply data mining  
algorithms



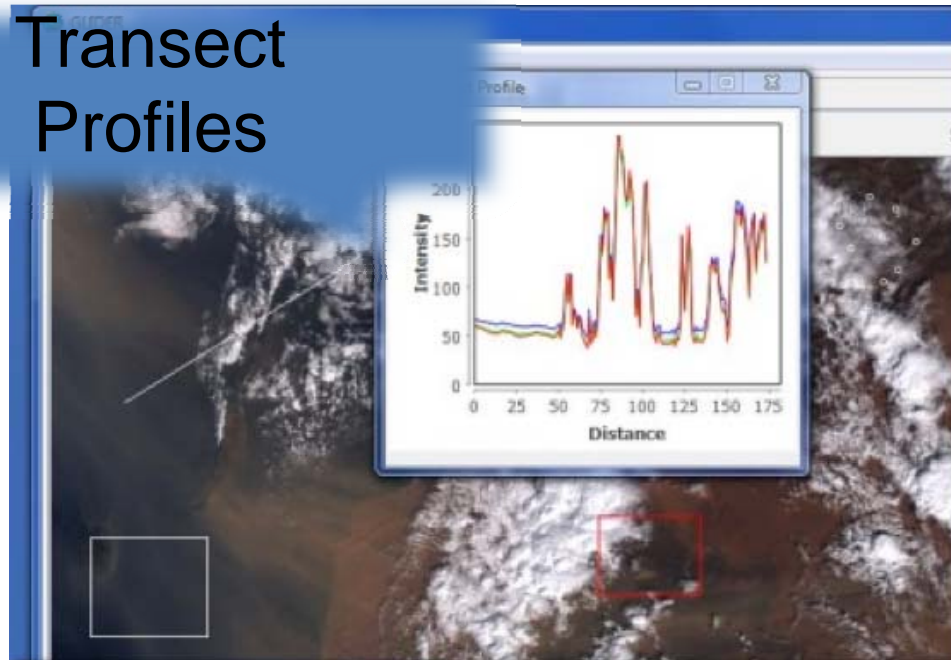
Visualize data in its  
native sensor view

Select different  
spectral bands

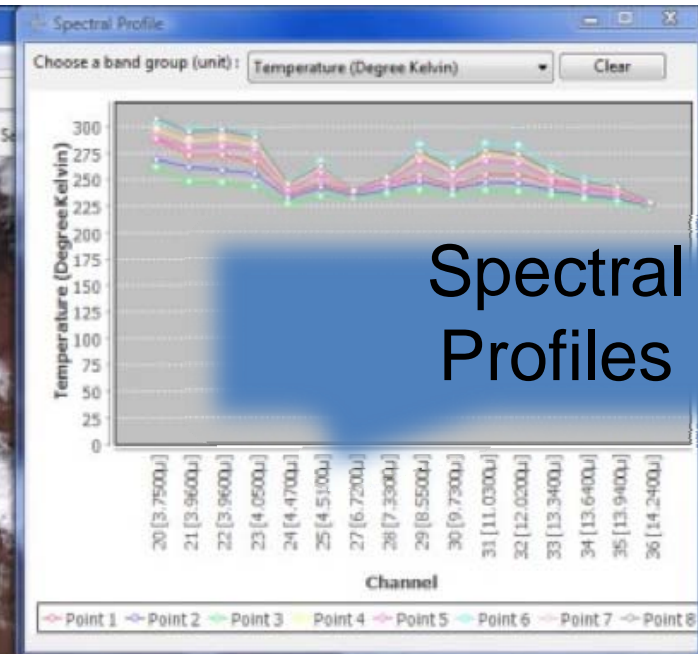


# Image Analysis Features

Transect  
Profiles



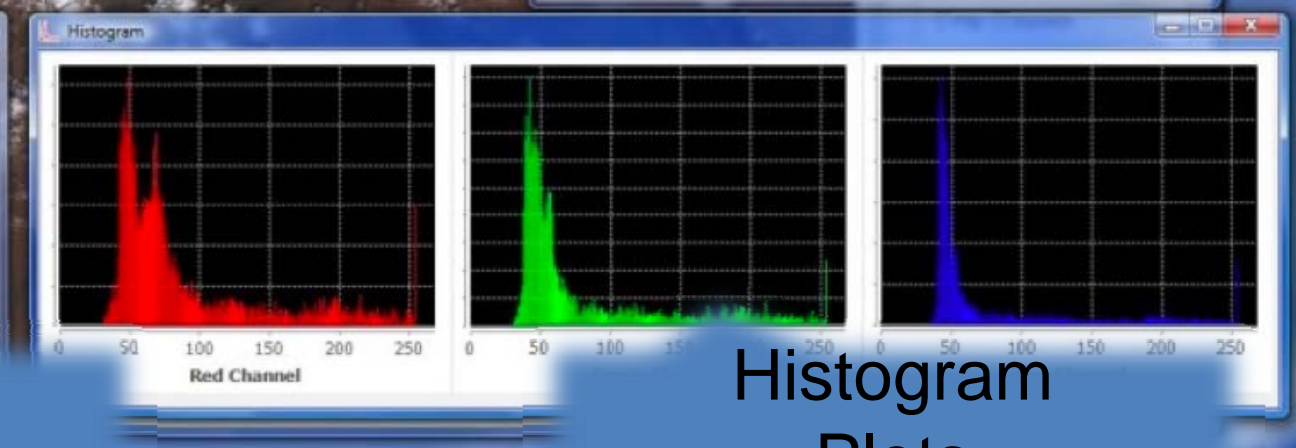
Spectral  
Profiles



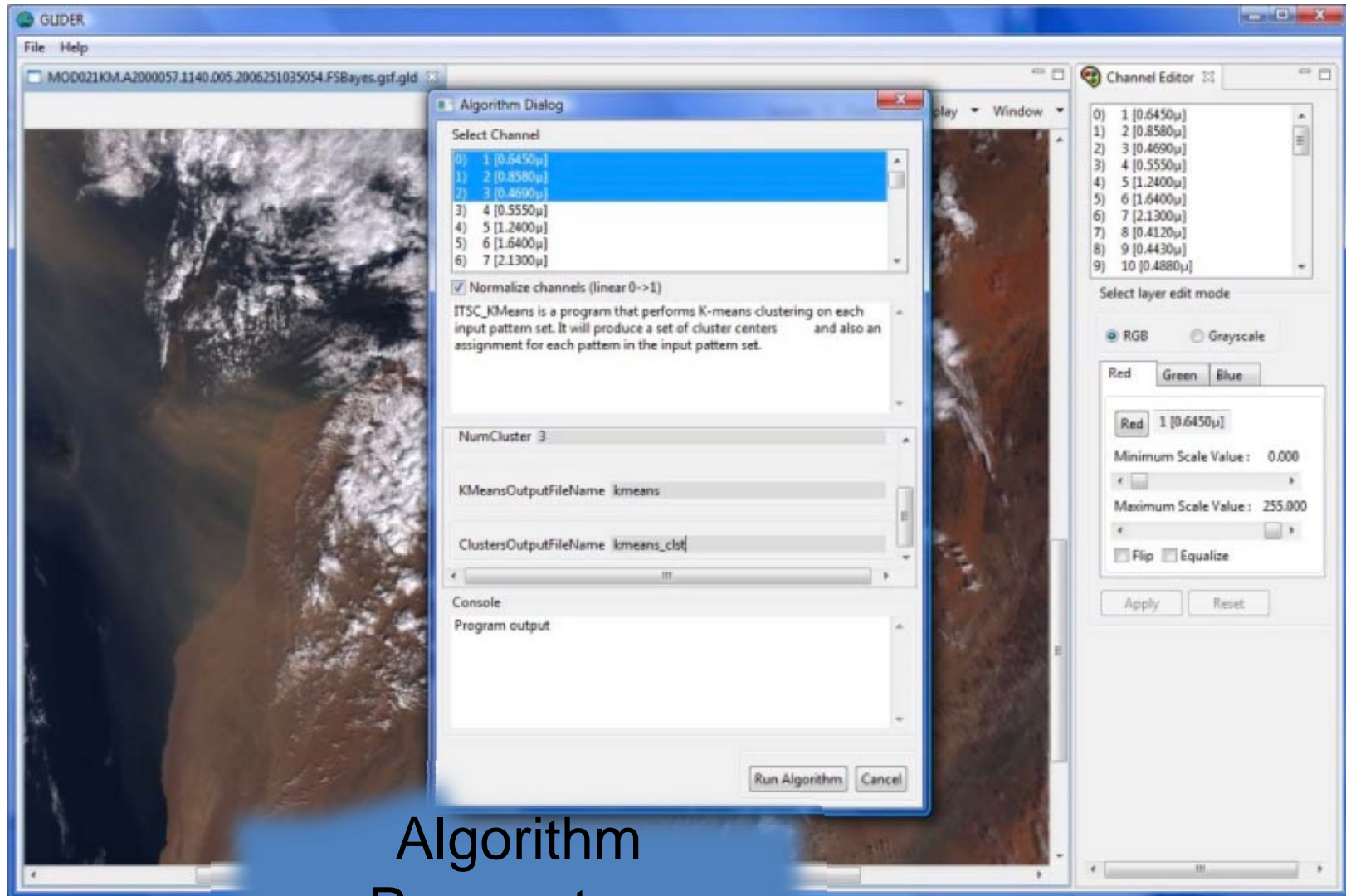
Scatter  
Plots



Histogram  
Plots



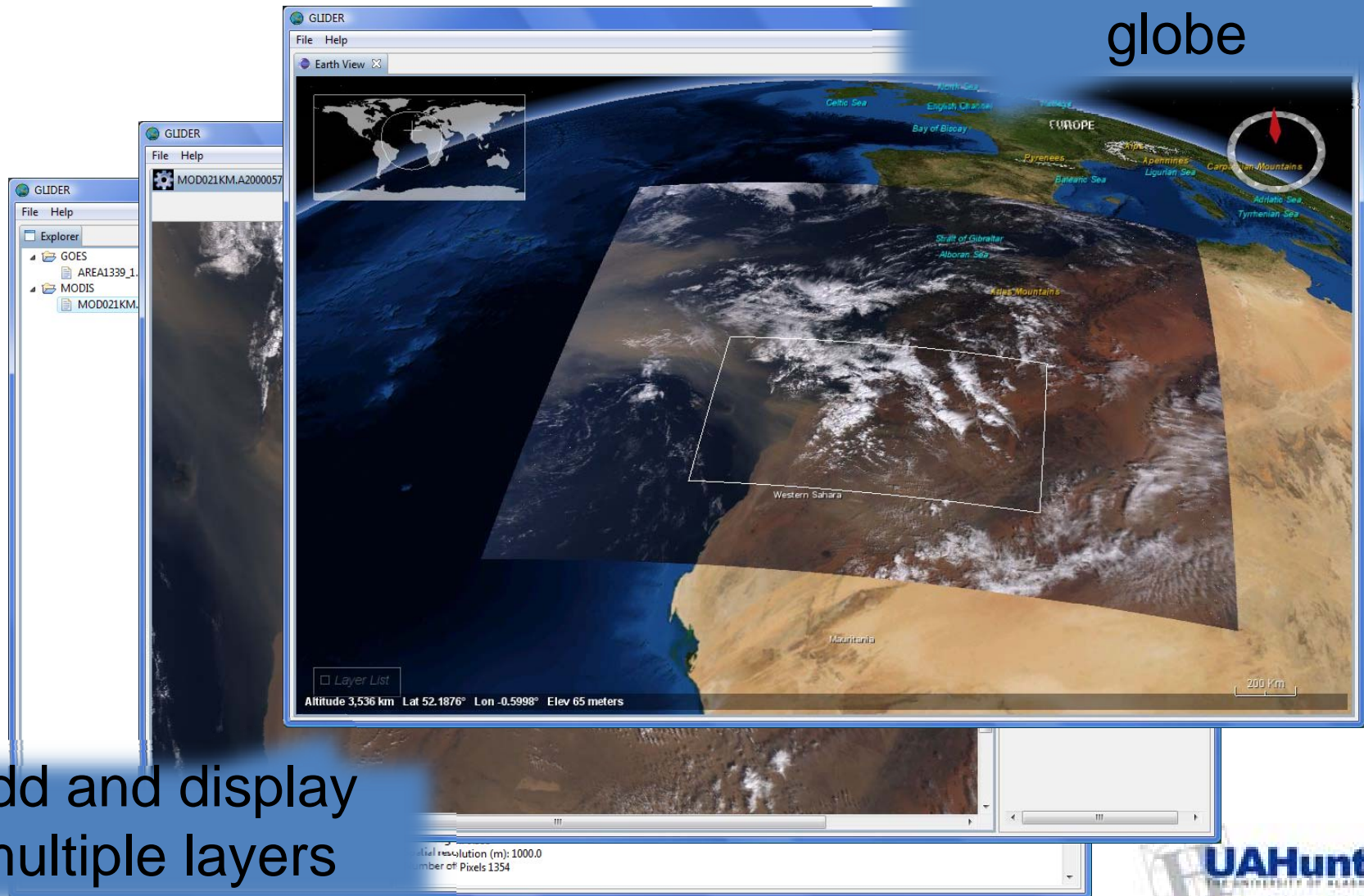
# Clustering Algorithm Example



Algorithm  
Parameters

# GLIDER Views: Earth View

Project images on the  
globe

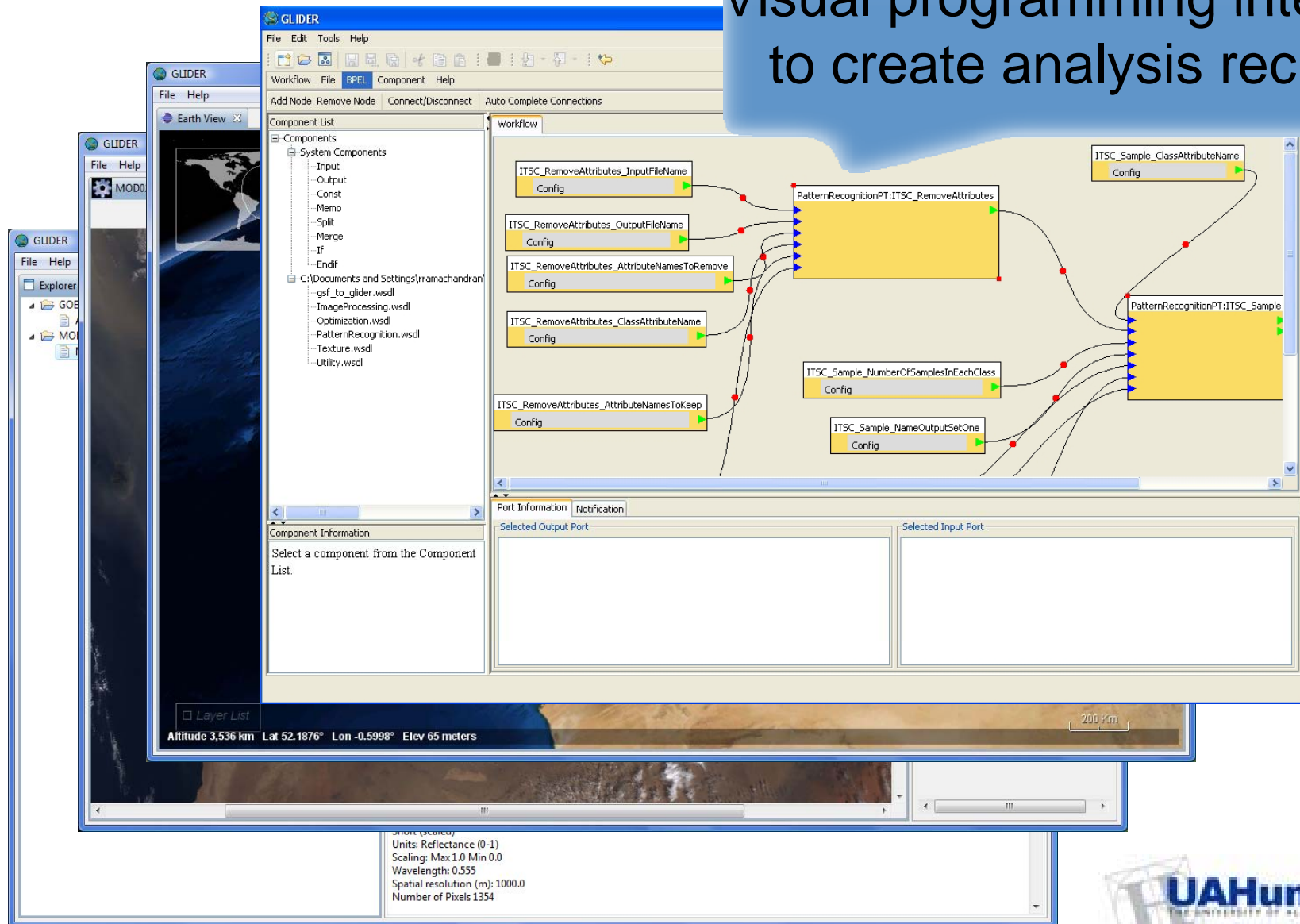


Add and display  
multiple layers



# GLIDER Views: Workflow Composer

Visual programming interface  
to create analysis recipes



# Demo

Look at Ash/Steam Plume event from  
Iceland's Eyjafjallajökull Volcano

Learn how to subset imagery both spatially  
and spectrally

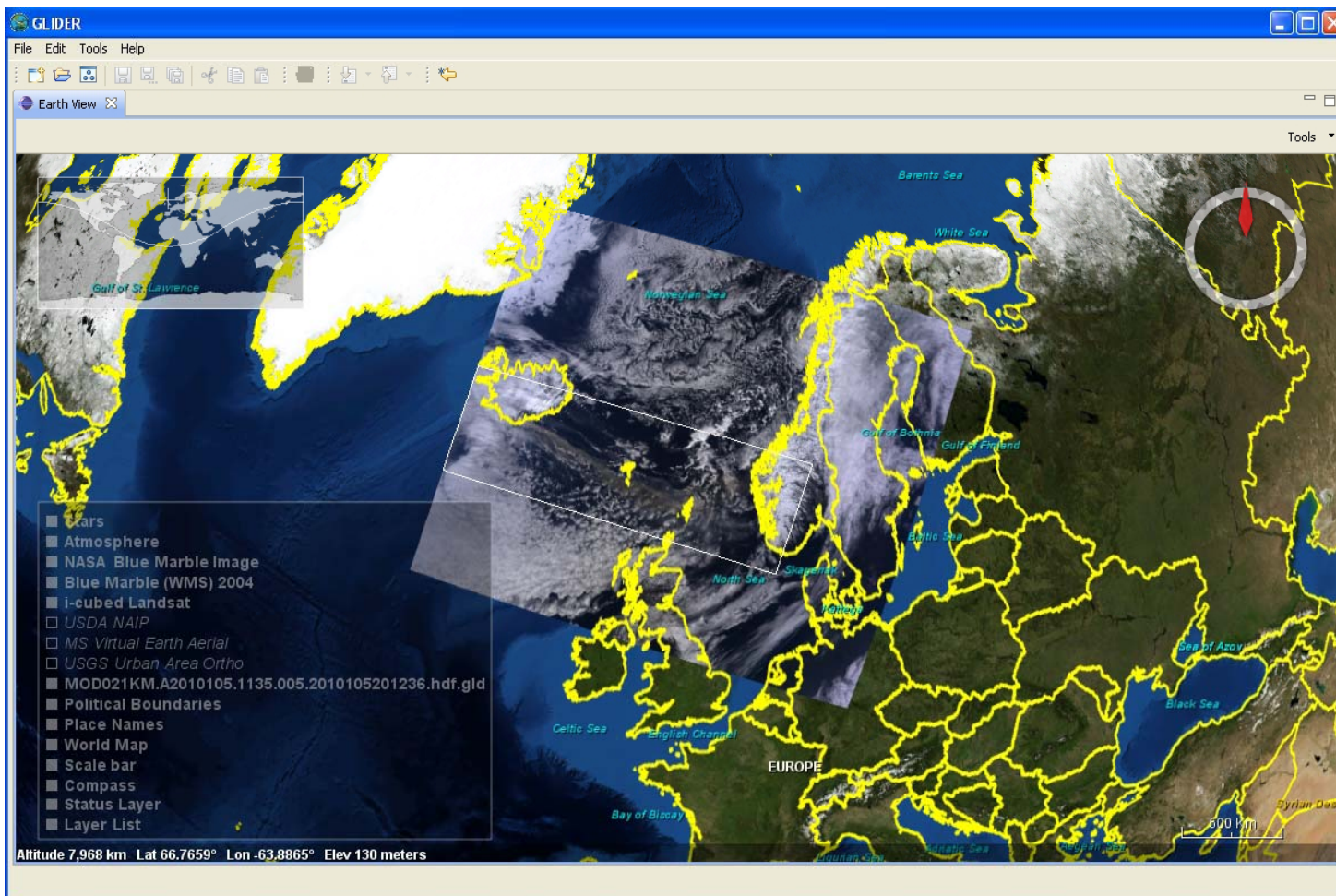
Apply clustering algorithm to generate  
classification maps

# Let's Apply a Clustering Algorithm

- Goal – Create a thematic/classification map using MODIS L1B data with three classes: Clouds, Ash/Steam and Ocean
- Methodology:
  - Subset the data both spatially and spectrally
  - Apply K-Means with  $k=5$  and let the algorithm find groups in spectral feature space
  - Assign semantic (3) classes to the 5 groups

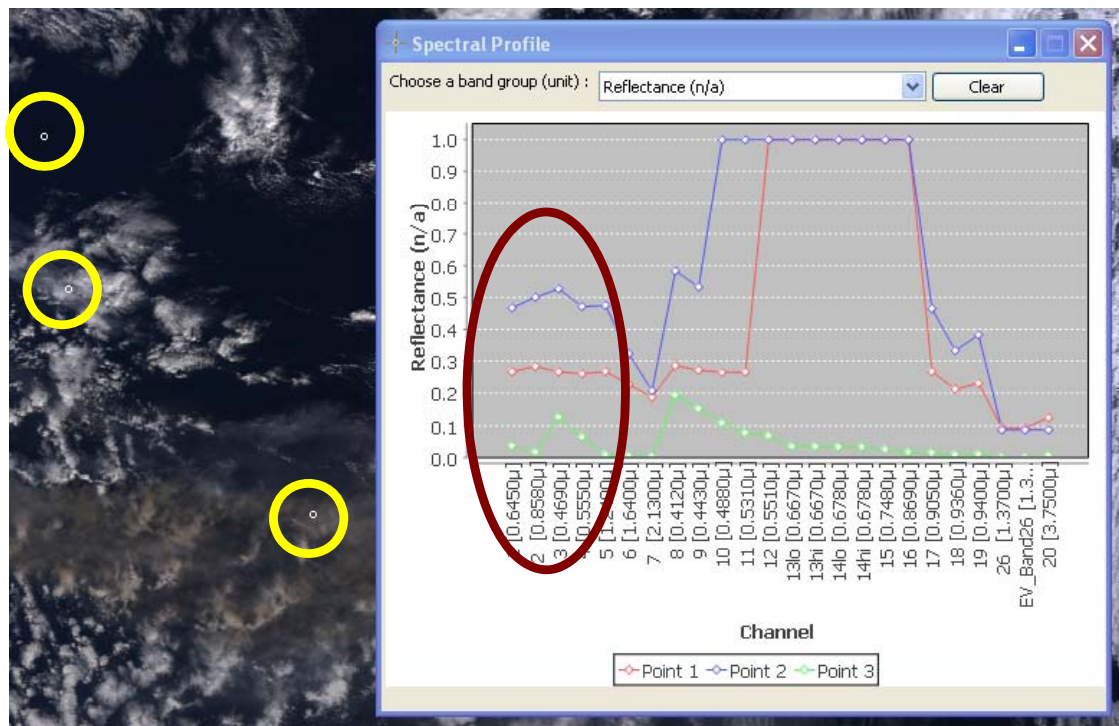
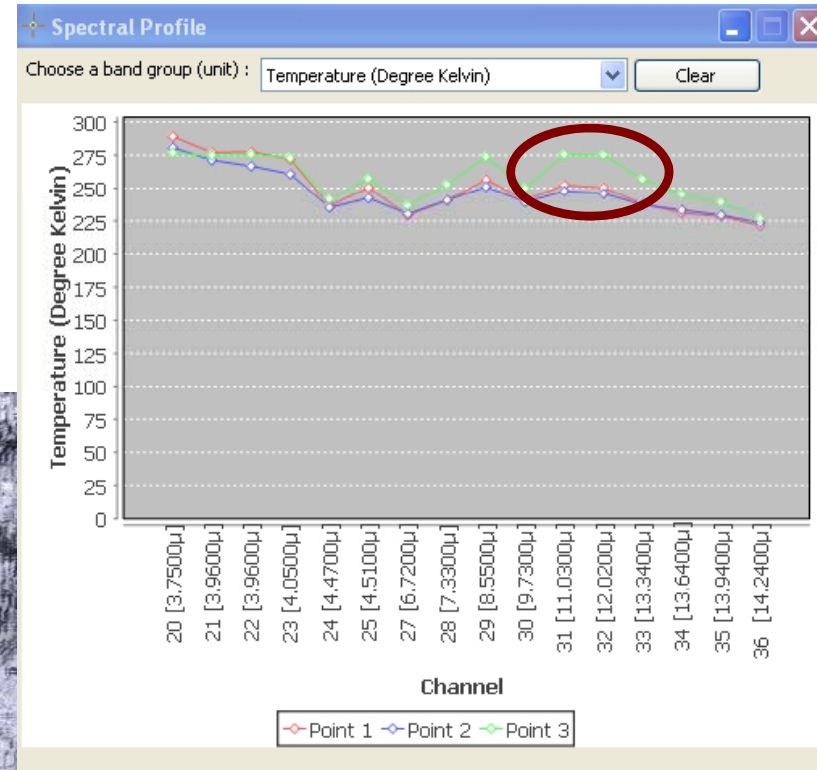
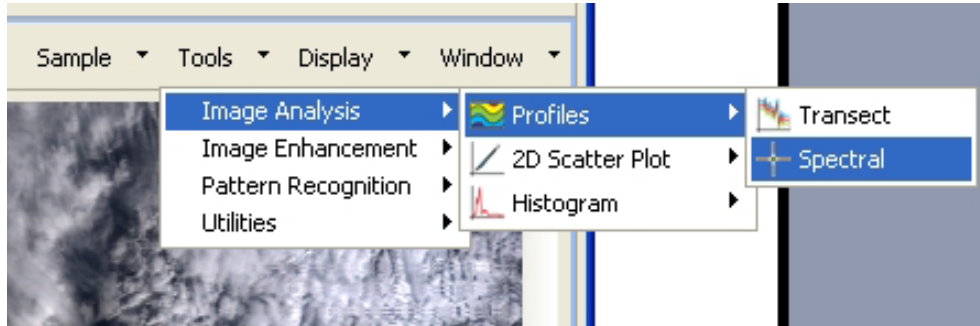
# Lets Apply a Clustering Algorithm

- Open MOD021KM.A2010105.1135.005.2010105201236.hdf.gld in Image View and Earth View
- Locate the Ash/Steam in the image





# Look at the Spectral Signatures for Clouds, Ash/Steam and Ocean

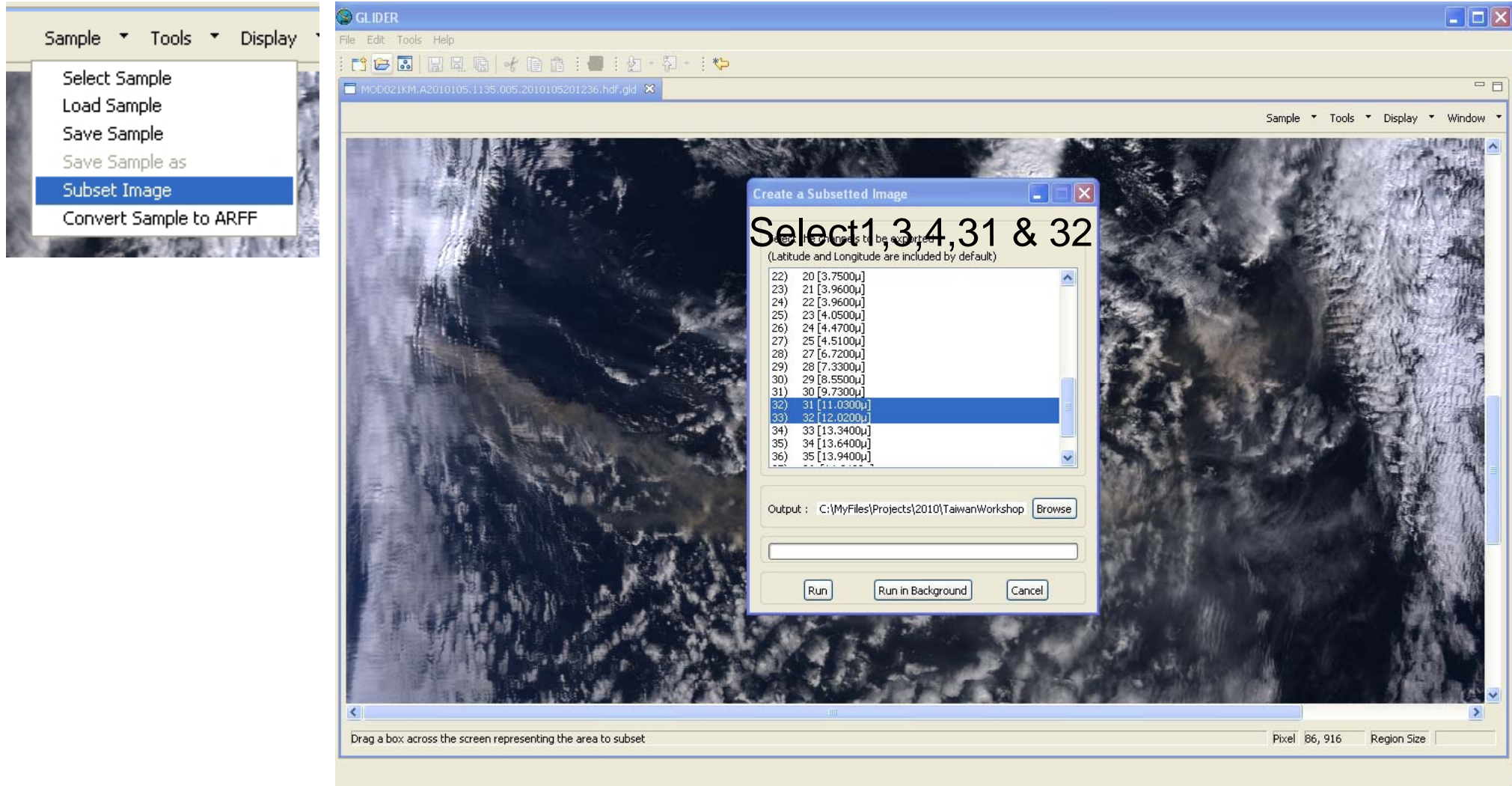


Lets keep bands 1,3,4,31 & 32

Select representative pixels for Ash, Cloud, Ocean

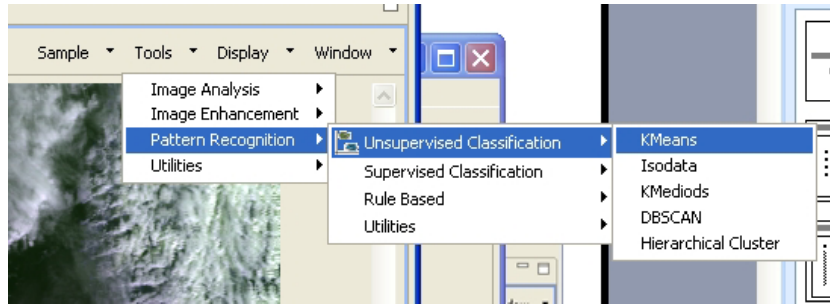


# Spatially and Spectrally Subset Data

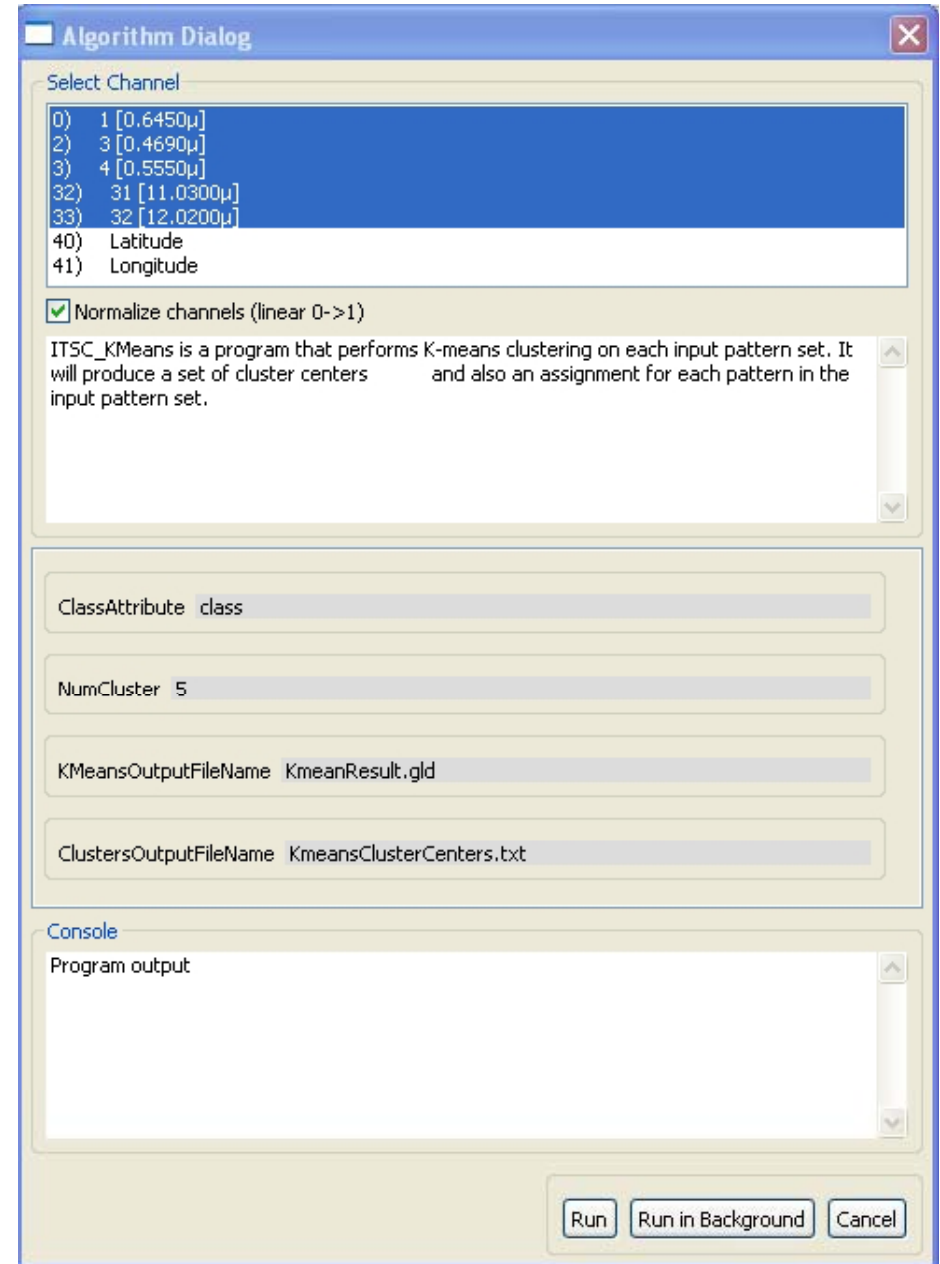


Select an area within the Image View, then select Bands, provide output filename (subset.gld) and hit Run button. Go to Project View and load subset.gld in Image View

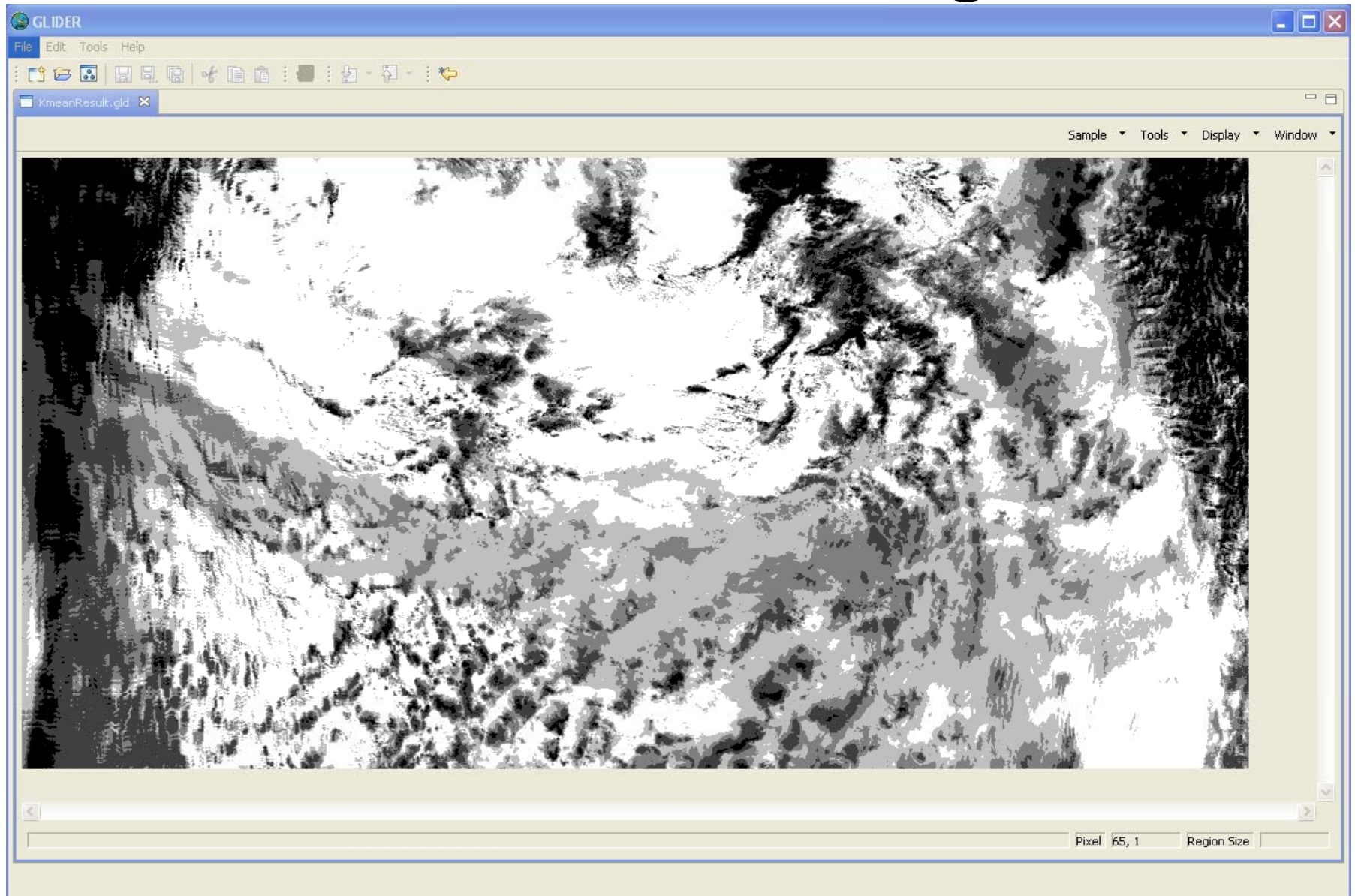
# Apply KMeans Algorithm



- Only select the spectral bands
- Make sure you select normalize channels
- Set the # of clusters to 5 even though we only want three final classes
- We will merge clusters at the end!



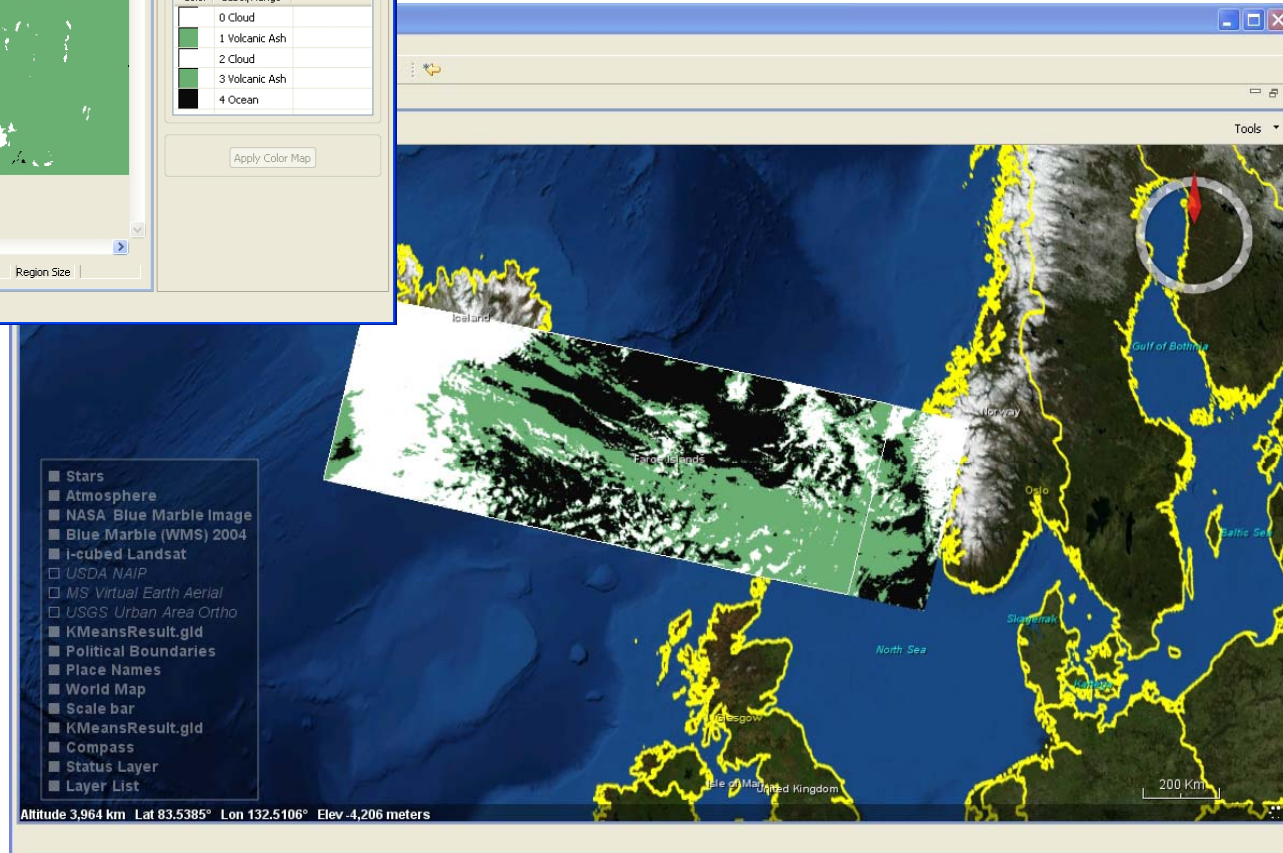
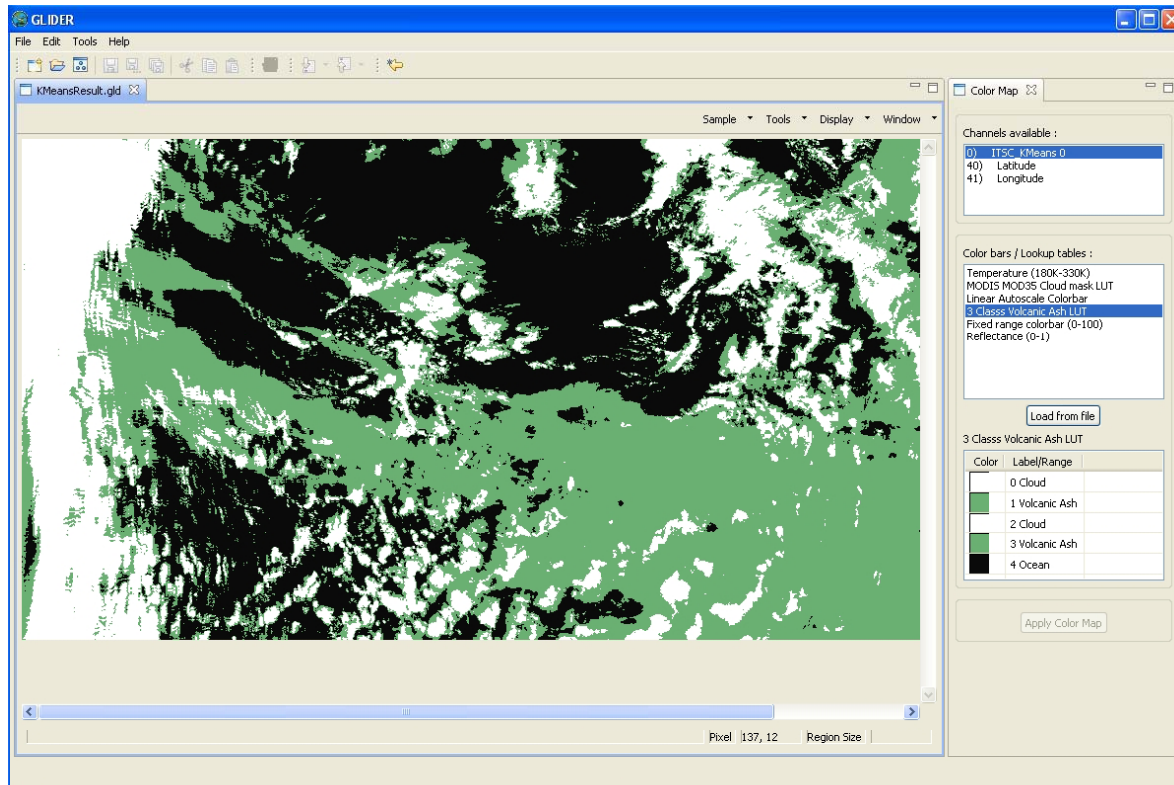
# Visualize Result in Image View



Lets merge classes to create a map with only three classes  
Load the ClassLUT.txt Color Map



# Final Clustering Result



# Education and Training

- GLIDER as classroom tool
- Air Quality Training
  - Other potential end users include, Forest Service, NOAA, and EPA.

# Use GLIDER to examine the data

- GLIDER: <http://miningsolutions.itsc.uah.edu/glider/>



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 [ABOUT](#)[ITSC](#)[UAHUNTSVILLE](#)

GLIDER is a FREE tool to easily visualize, analyze and mine satellite imagery.



Full swath display



Histograms, Scatter plots



Image processing algorithms



Satellite image calibration



Spectral profile, Linear  
transect



Clustering algorithms



## GLIDER SOFTWARE

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## GLIDER V2.1-BETA IS NOW AVAILABLE TO DOWNLOAD!

Posted Thu, 12/10/2009 - 09:10 by RxR

GLIDER v2.1-beta Features and Bug Fixes

**Bug fixes**

**tsville**  
DATA TO KNOWLEDGE

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